

Statistical Testing Examples and Questions

1. An automobile manufacturer claims that the new Model X car introduced this spring has an average MPG rating of 28 mpg. To check their claim, we test-drive 100 cars and find an average rate of 29.8 mpg for these cars, with a standard deviation of 6.6mpg.

2. The following are the math SAT scores of a random sample of 20 students at a New Jersey high school:

485, 516, 600, 501, 618, 492, 521, 680, 552, 695,
577, 610, 652, 545, 560, 480, 640, 568, 620, 550

Test the null hypothesis that the average math SAT score for this school is 540 versus the alternative that it is higher.

3. On average, do males outperform females in mathematics? To answer this question, psychologists at the University of Minnesota compared the scores of male and female eighth-grade students who took a basic skill math test. A summary of the test scores is displayed below.

	Males	Females
Sample Size	1764	1739
Mean	48.9	48.4
Standard Deviation	12.96	11.85

4. The Cleveland Casting plant produces iron automotive castings for Ford. When the process is stable, the target pouring temperature of the molten iron is 2,550 degrees. The pouring temperatures for a random sample of 10 crankshafts produced at the plant are listed below. Does the mean pouring temperature differ from the target setting?

2543, 2541, 2544, 2620, 2560, 2559, 2562, 2553, 2552, 2553

5. According to USA Today (Dec. 1999) the average age of MSNBC TV News viewers is 50 years. A company wants to market a product for this age group, but wants to ensure that the USA Today study is correct before investing advertisement money. They select 50 US households at random that view MSNBC TV News and find their average age to be 51.3 years with a standard deviation of 7.1 years. Should the company invest in advertising?

6. The “fear of negative evaluation” (FNE) scores for 11 bulimic female students and 14 normal female students are shown below (the higher the score, the greater the fear of negative evaluation). What is the average FNE score of bulimic female students and that of normal female students? Is there a significant difference between the mean FNE scores?

Bulimic students: 21, 13, 10, 20, 25, 19, 16, 21, 24, 13, 14

Normal students: 13, 6, 16, 13, 8, 19, 23, 18, 11, 19, 7, 10, 15, 20

7. Suppose you want to compare a new method of teaching reading to “slow learners” to the current standard method. You select a random sample of 22 slow learners; 10 of them are taught by the new method and 12 are taught by the standard method, for the same period of time. The reading scores for the two groups were as follows:

New Method	Standard Method
80, 80, 79, 81, 76, 66, 71, 76, 70, 85	79, 62, 70, 68, 73, 76, 86, 73, 72, 68, 75, 66

- a) What is the difference in average reading scores between the two methods?
- b) Conduct a test to determine whether the new method is better than the standard method.

8. Please provide brief answers to the following questions:

- a) If you are using z-distribution for a statistical test, the number z_0 you compute is $z_0 = 2.1$, and the corresponding p-value for that value of z_0 is $p = 0.0179$. What is your conclusion for the corresponding test?
- b) If you are using z-distribution for a statistical test, the number z_0 you compute is $z_0 = 1.64$, and the corresponding p-value for that value of z_0 is $p = 0.0505$. What is your conclusion for the corresponding test?
- c) If you are using a z-distribution for a statistical test and the computed z-value is $z_0 = 1.96$, what is the associated p-value (use StatCrunch to compute the probability)
- d) If you are using a t-distribution with $df = 10$ for a statistical test and the computed t-value is $t_0 = 2.05$, what is the associated p-value (use StatCrunch to compute the probability)
- e) You are conducting a statistical test for the population mean. The null hypothesis is $H_0 = 17.1$, while the alternative hypothesis is $H_a \neq 17.1$. The sample size is large enough to use a normal distribution, and the statistics for the sample turns out to be $z_0 = 2.045$. Using StatCrunch you compute the p-value to be 0.0404 . What is your conclusion?
- f) A statistical test for the population mean at results in your rejection of the null hypothesis because $p = 0.015$. Can the null hypothesis still be true? If so, what is the probability that the null hypothesis is true, even though you rejected it?
- g) Someone is interested in designing a statistical test for the mean of a population. In deciding whether to use a test based on the t -distribution or a test based on the standard normal distribution, what is the deciding factor?